

Project No. 84-Q3 - Tree and Crop Research
Nitrogen on Drip Irrigated Almonds

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Objectives: (1) To evaluate the effects of different nitrogen rates applied at two water levels on growth, nutrient concentrations in leaves and twigs, and nut yields. (2) To assess the extent of soil acidification under drip emitters.

Interpretive Summary: Drip irrigation has a dramatic influence upon the rooting pattern of trees. Because of the confined soil area from which the tree roots must take up both water and nutrients, this situation offers opportunities and potential problems. Numerous applications of fertilizer injected into the drip irrigation system throughout the growing season provide a way to maximize the utilization of plant nutrients. The high concentrations of some fertilizers, such as the ammonium form of nitrogen, may result in an undesirable plant root environment. The low pH created may bring into solution sufficient levels of manganese and aluminum to reach toxic proportions. Monitoring the nitrogen status of trees with the help of early dormant season twig samples may provide an effective and more desirable time for growers to develop fertility management strategies.

This experiment was established at the Nickels Estate with ten treatments, five rates of nitrogen at each of two water levels. The water levels were 0.6 and 1.0 of evapotranspiration and nitrogen rates were 0, 0.5, 1.0, 1.5 and 2.0 ounces per tree in 1982; 0, 0.8, 1.7, 3.5 and 7.0 ounces per tree in 1983 and 0, 2, 4, 8 and 16 ounces per tree in 1984. The nitrogen source used was urea with the 0.5 and 1.0 or the 0.8 and 1.7 ounce treatments divided equally among April, June and August applications (60 day intervals). The 1.5 and 2.0 or the 3.5 and 7.0 ounce treatments were divided among April, May, June and August applications (40 day intervals). All nitrogen treatments during 1984 were applied at the 40 day interval beginning April 1st and ending August 1st. Each treatment was applied to two replications of the three almond varieties--Butte, Carmel and Nonpareil.

Almond meat yields during 1984 (fourth season) ranged from about 400 to slightly over 1800 pounds per acre (12' X 18' spacing, 196 trees/A). It should be noted that the weather in the spring of 1984 was very favorable for attaining high yields. The three varieties responded somewhat differently with the Nonpareil having the same yield level for irrigation treatments and an increase from about 700 to 1400 pounds meats per acre for the 0 to 16 ounce nitrogen rates (Figure 1). The Carmel variety had nearly the same average response to nitrogen (about 800 to 1500 pounds meats per acre), but showed a markedly greater response to nitrogen at the 1.0 ET irrigation level (approx. 1700 at the 16 oz N/A) (Figure 2). The Butte variety showed a yield different between the two irrigation levels at all rates of nitrogen with the 1.0 ET treatment averaging about 200 pounds more meats. Also the 8 and 16

ounces N/tree rates gave nearly the same yield (Figure 3).

The pattern established in 1983 of total nitrogen concentration in the leaves being the same in April and then gradually increasing as more nitrogen and water are applied was repeated during 1984. The initial levels were somewhat different however, with the concentration being about 3.7% in April 1983 compared to 2.2% in April 1984. The rather low concentration in April 1984 could be due in part to the extremely large set and developing nut yield. Increasing nitrogen concentrations did start appearing in the May and June leaf samples following the differential nitrogen rates applied. It is very interesting to note that twig total nitrogen concentrations in samples taken on December 28, 1983 showed higher levels of nitrogen with higher rates of applied nitrogen but no difference between irrigation levels. This was the situation observed in fall leaf sample total nitrogen concentrations.

Average increases in cross-sectional tree trunk area relationships from 1982-83 have shown larger differences with increasing rates of applied nitrogen and water (Figure 4). Whereas the difference between the 0.6 and 1.0 ET water level was the same for all nitrogen rates during the 1981-82 period, the higher water level combined with higher nitrogen rates is showing larger increases in cross-sectional trunk area.

Preliminary investigations of soil acidification indicate a dramatic lowering of pH levels immediately under the point of emitter discharge. This warrants continued evaluation as higher rates of nitrogen will be necessary for the growing trees and as more intense soil acidification could bring certain elements such as aluminum and manganese into soil solution in concentrations that may become toxic to tree roots.

Figure 1

NONPARIEL ALMOND MEAT YIELDS IN 1984 AS INFLUENCED BY NITROGEN RATE AND WATER APPLIED THROUGH DRIP SYSTEM. NICKELS RANCH.

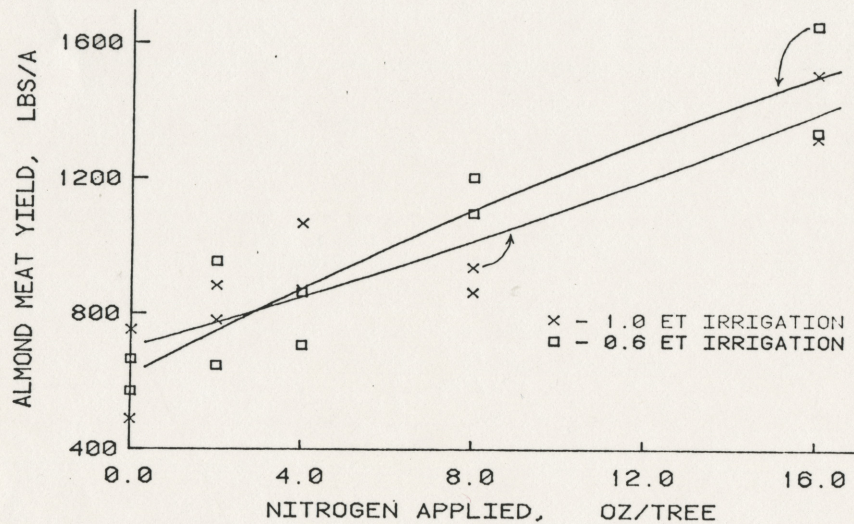


Figure 2

CARMEL ALMOND MEAT YIELDS IN 1984 AS INFLUENCED BY NITROGEN RATE AND WATER APPLIED THROUGH DRIP SYSTEM. NICKELS RANCH

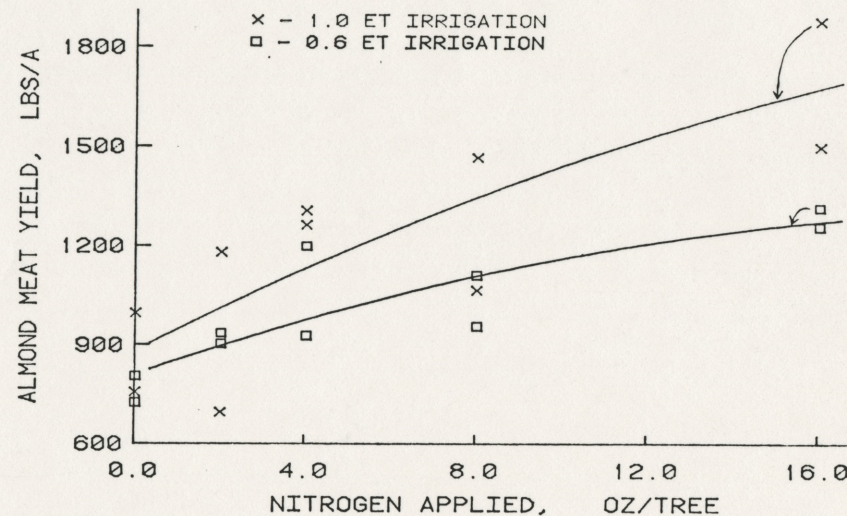


Figure 3

BUTTE ALMOND MEAT YIELDS IN 1984 AS INFLUENCED BY NITROGEN RATE AND WATER APPLIED THROUGH DRIP SYSTEM. NICKELS RANCH

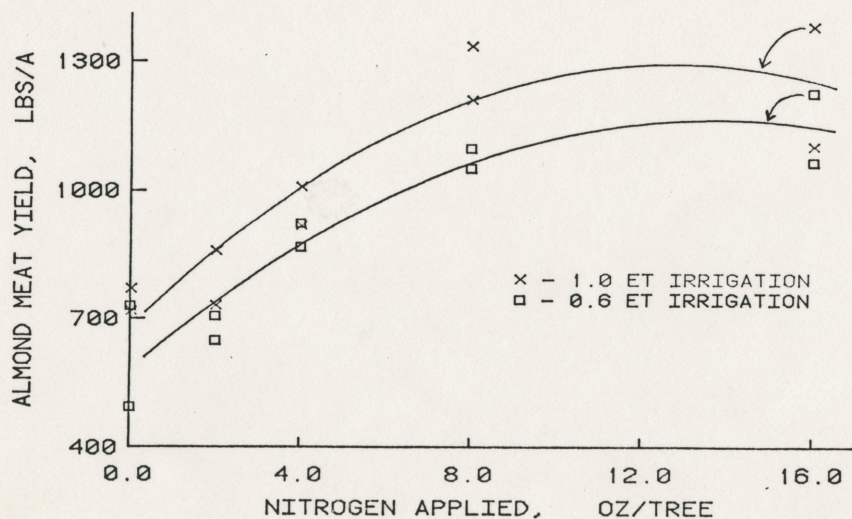


Figure 4

TOTAL NITROGEN CONCENTRATION IN ALMOND TWIGS ON DECEMBER 28, 1983 AS INFLUENCED BY NITROGEN RATE AND WATER APPLIED THROUGH DRIP SYSTEM. NICKELS RANCH.

